

**Certified
Naval Battle Groups**



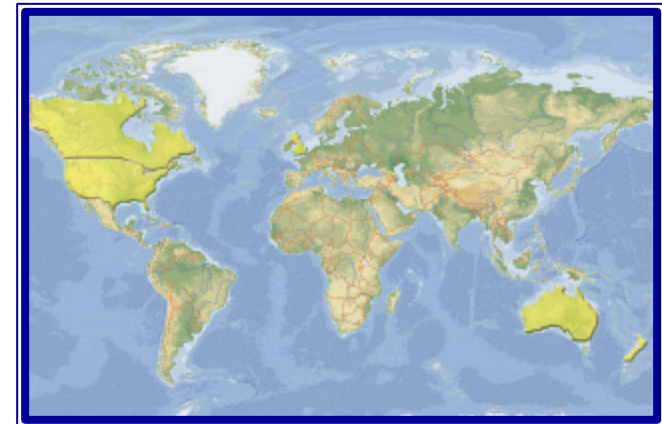
Coalition Integrated Air Picture Architecture Description

**NDIA Systems Engineering Conference
October 21-24 2002**

**Dr. C.E. Dickerson
Director of Architectures**



- Architectural Framework & Application to System Engineering
- Potential Coalition Partner Component of the Single Integrated Air Picture
- Summary and Next Steps



Present CIAP Exploratory Architecture Development Among The Coalition Partners



Architecture Definition

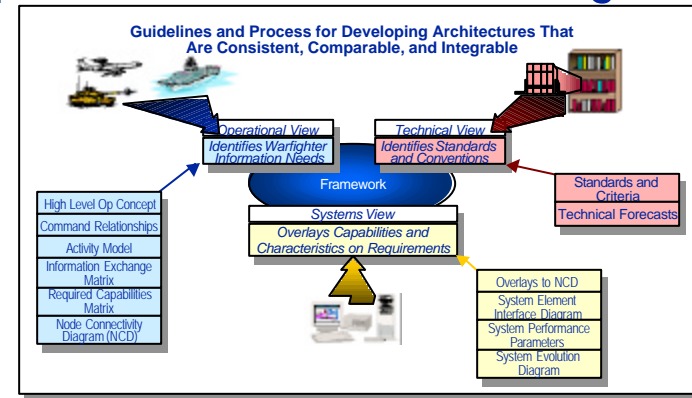
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- “Architecture”

“The structure of components, their relationships, and the principles and guidelines governing their design and evolution over time”

- IEEE STD 610.12 as adapted by the U.S. DOD C4ISR Architecture Framework, Version 2.0, 18 December 1997

- Documenting the Architecture allows users to visualize expected capabilities and system engineers to visualize functions that system must perform, which systems must exchange data, and what the protocols needed for exchange



Architectures Provide the Framework for Establishing Operational Uses of a System of Systems and for Systems Engineering

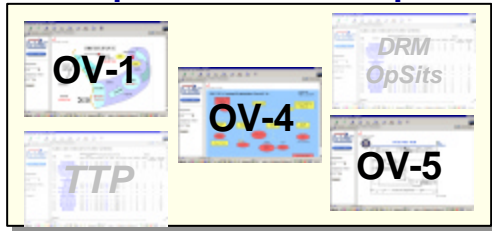


Using Architectures in Systems Engineering & Acquisition

Rev 4 (1)
22 Apr 02

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Operational Concept

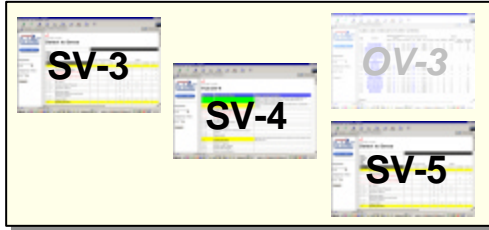


Lesser

The Role of Engineering and Technology

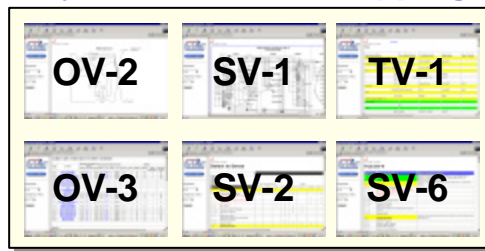
Greater

System Functional Mapping



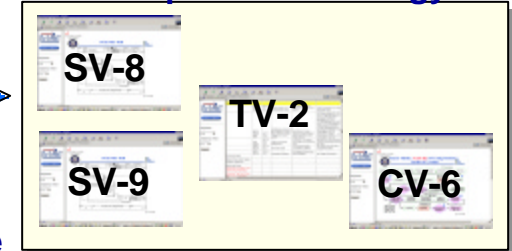
1st Order Analysis:
Functionality--

System Interface Mapping

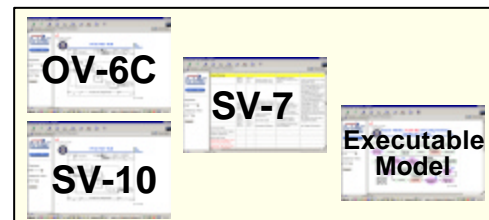


2nd Order Analysis:
Static Interoperability

Acquisition Strategy



Architecture Performance and Behavior



3rd Order Analysis:
Dynamic Interoperability

DRM: Design Reference Mission
OpSit: Operational Situation
TTP: Tactics, Techniques, Procedures

Note: There are dependencies between the Architecture products that are not shown in the System Engineering flow. Many of the products are developed concurrently.

**Architectures Provide the Framework for
FoS/SoS Systems Engineering & Acquisition**

- CV-6 Capabilities Evolution Description
- OV-1 High-level Operational Concept Graphic
- OV-2 Operational Node Connectivity Description
- OV-3 Operational Information Exchange Matrix
- OV-4 Command Relationships Chart
- OV-5 Activity Model
- OV-6C Operational Event/Trace Description
- SV-1 System Interface Description
- SV-2 Systems Communication Description
- SV-3 Systems Matrix
- SV-4 System Functionality Description
- SV-5 Operational Activity to System Function Traceability Matrix
- SV-6 System Information Exchange Matrix
- SV-7 System Performance Parameters Matrix
- SV-8 System Evolution Description
- SV-9 System Technology Forecast
- SV-10 System Activity Sequence & Timing
- TV-1 Technical Architecture Profile
- TV-2 Standards Technology Forecast



- Architectural Framework & Application to System Engineering
- Potential Coalition Partner Component of the Single Integrated Air Picture
- Summary and Next Steps

SIAP Operational Concept

- The Coalition Component of Single Integrated Air Picture is a database of threat, friendly and unknown,, tracks, identified, geolocated, time referenced, and maintained jointly in near real-time by the coalition partners. Will also provide the capability to share, but not develop, joint planning information, such as Air Tasking Orders and areas of sensor responsibility.

Need to populate with specific coalition platforms and systems



SIAP Operational Concept Is Being Used As a Starting Point for Coalition Operational Concept Discussed



Potential Capstone Requirements

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- Capability Requirements
 - 360 degree multi-dimensional surveillance coverage
 - Common, continuous, and unambiguous Battlespace Air Picture
 - Combat identification
 - Tactical and Intelligence Data Exchange
- Key Performance Parameters
 - Minimum number of sensors and tracks supported ⁽¹⁾
 - Track association probability ⁽¹⁾
 - Track accuracy ⁽¹⁾
 - Combat identification/misidentification probabilities ⁽¹⁾
 - Track information exchange requirements
 - Joint planning information exchange requirements

(1) Need to be specified relative to inherent sensor, navigation accuracies

**Actual Capstone Requirements Need to be Determined by
Coalition Partners**



Connectivity Between Command Levels

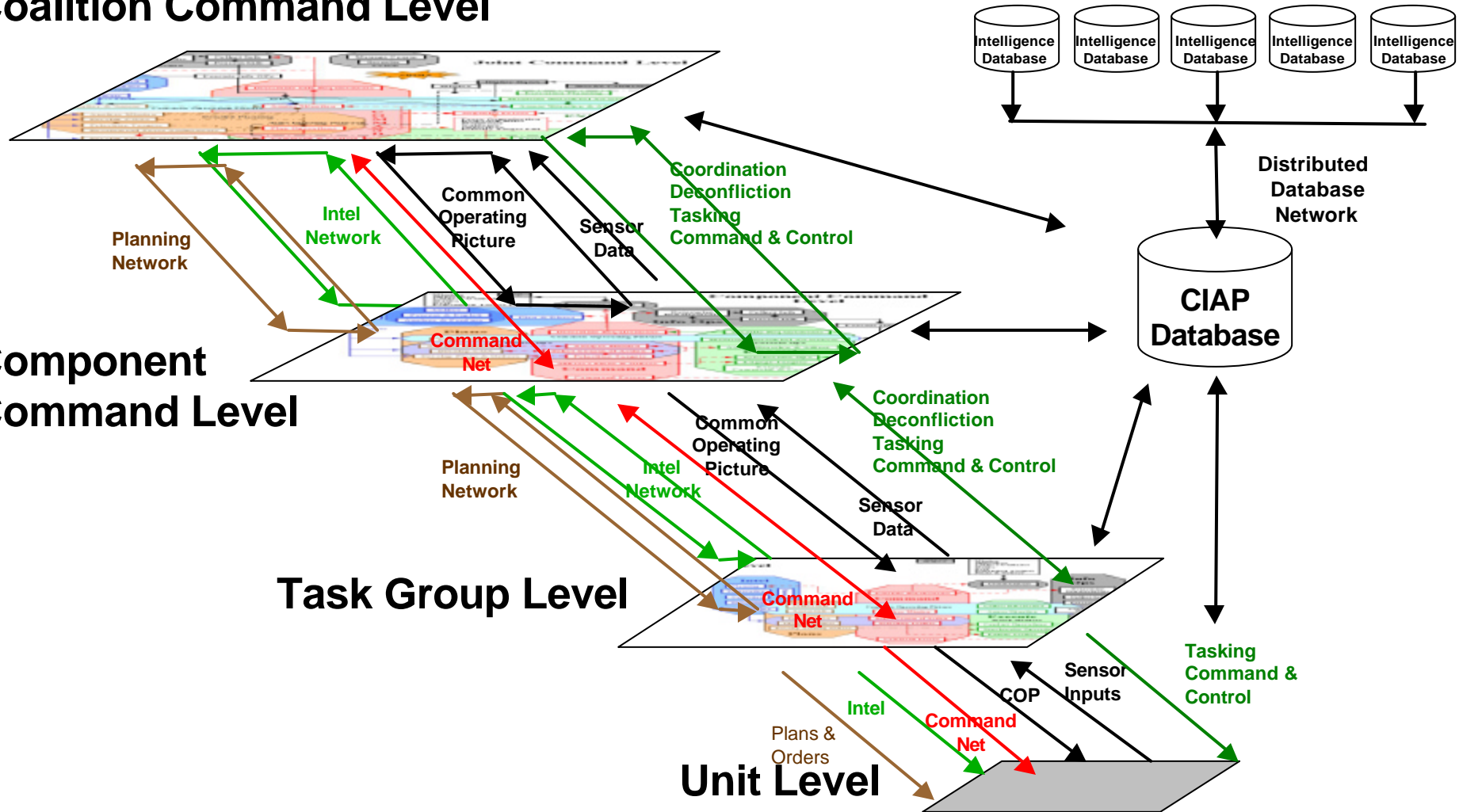
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Coalition Command Level

Component Command Level

Task Group Level

Unit Level



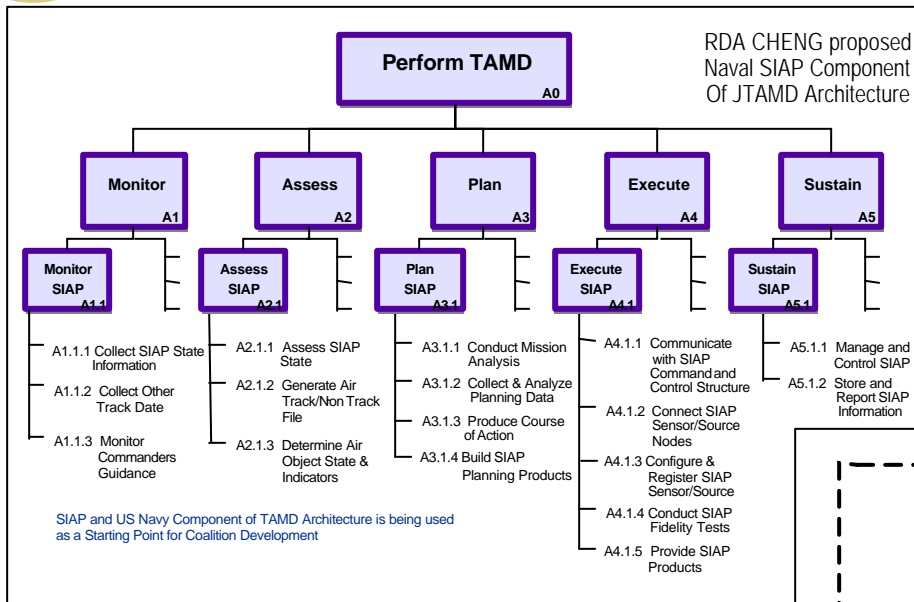
Data Exchanges Among Command Levels is a Driver on Information Exchange Requirements



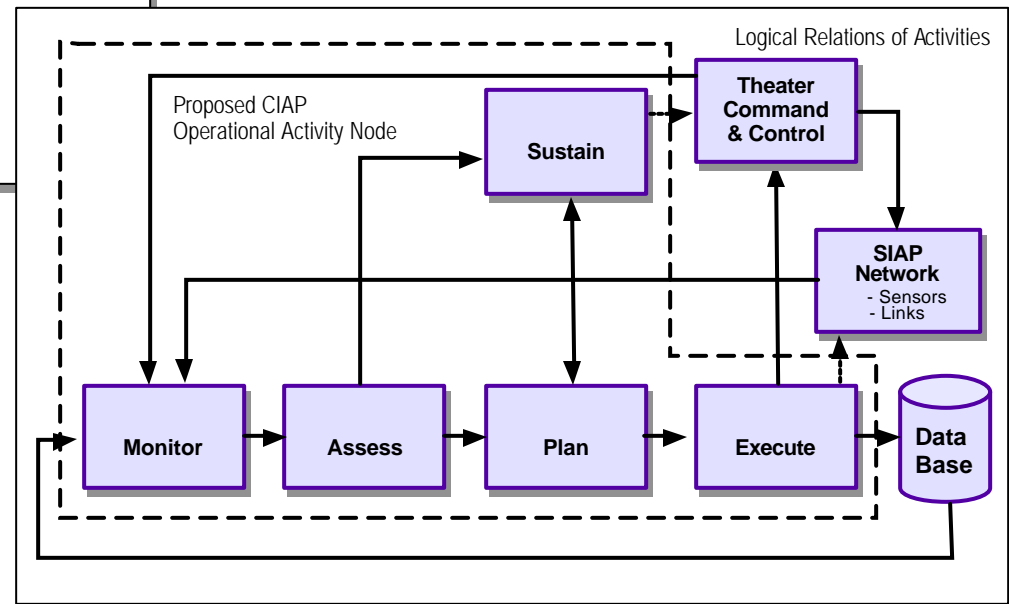
Naval TAMD Activity Model (OV-5)*

Preliminary Executable SIAP Decomposition

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Reference: JTAMDO and SIAP Activity Models



* The Naval Component of JTAMD is the Basis for PR-05 Naval TAMD

Performance will be Evaluated in an Executable Model of the Activities



System-to-Functional Mapping

Australian System Example

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	SV-4 Functions													
	TS	CSD	ISR	CISR	CFO	CTP	P	SA	D	CO	FP	EE	CS	CNT
2001 Systems														
Sensors														
AN/APG-65	x											x		
AN/APG-73	x											x		
SPS-49A(V)1	x													
Jindalee Operational Radar Network	x													
Weapons														
AIM-7F Sparrow												x		
AIM-9												x		
AMRAAM												x		
RAPIER												x		
RBS-70												x		
SM-1MR												x		
BFC2														
Link-4 A		x								x			x	
Link-11		x								x			x	
Defence Secret Network														
CWAN														
SPRNET														
Joint Command Support Environment														
Theater Battle Management Command														
2007 Systems														
Sensors														
AN/APG-73	x											x		
SPS-49A(V)1	x													
Jindalee Operational Radar Network	x													
MESA	x													
Weapons														
AIM-7F Sparrow												x		
AIM-9												x		
AMRAAM												x		
ASRAAM												x		
ESSM												x		
RAPIER												x		
RBS-70												x		
SM-1MR												x		
BFC2														
Link-4 A		x								x			x	
Link-11		x								x			x	
Link-16		x								x			x	
SATCOM										x				
Defence Secret Network														
CWAN														
SPRNET														
Joint Command Support Environment														
Theater Battle Management Command														

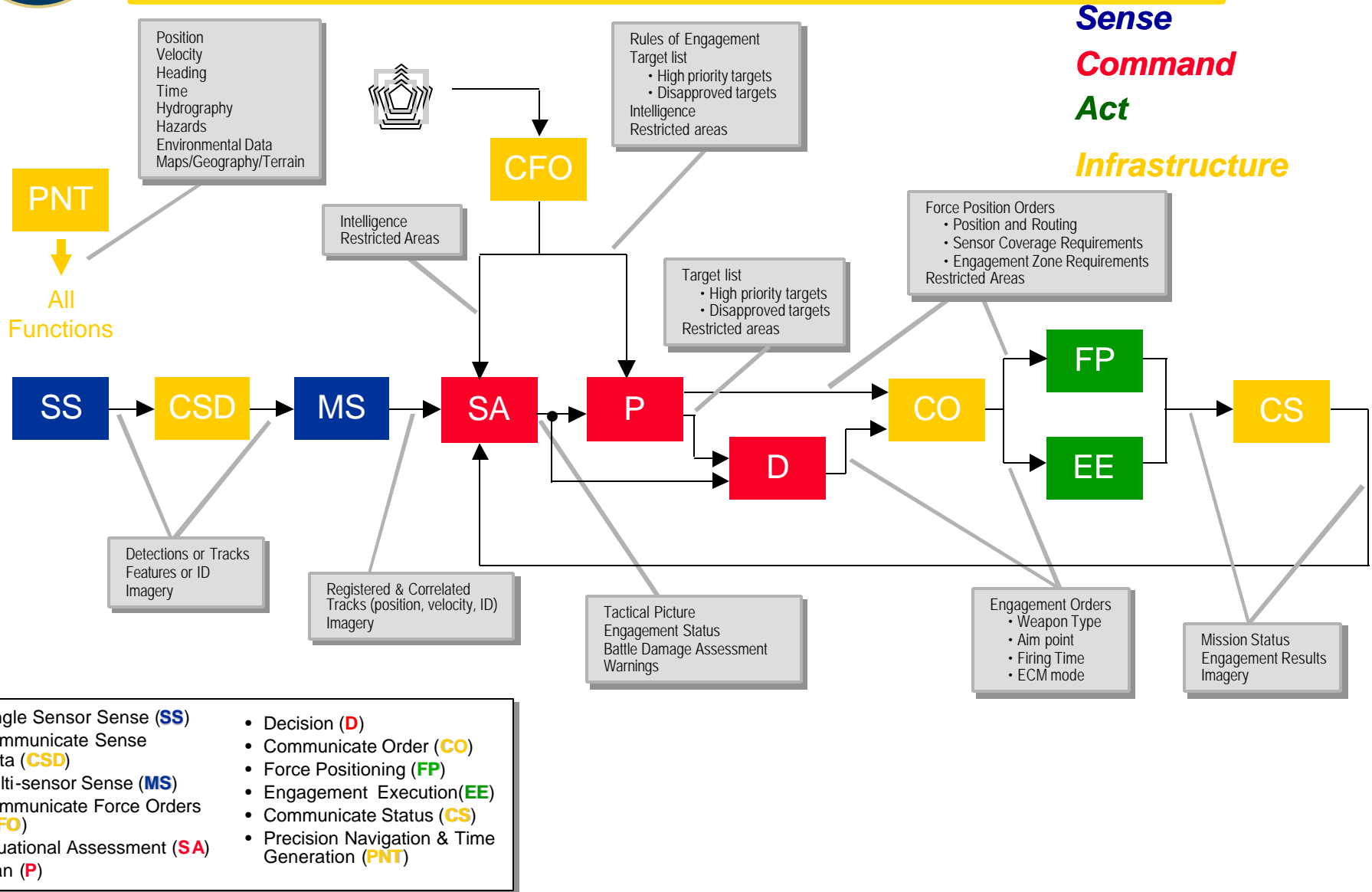
How the Coalition Partner systems support CIAP specific functions would be identified by allocations here

Under review by Australia



Logical Interface View (SV-4 Series)

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Reference: US ASN(RDA) Chief Engineer's Common Functional View for PR-05



System Mappings (SV-3 series)

US Navy System Example - Circa 2019

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System-to-Function Mapping (SV-3a)		Systems									
		AADC	AWS 7.2 OA	CEC 3.0	CG(X) BL 1.0	E-2C MC	Link-16	MFR	RMP (E-2C)	SPY-1D(V)	SSDS MK 2
Single Sensor Sense (SS)	Search	Horizon Air Active									
		Horizon Air Passive									
		Above Horizon Active									
		Above Horizon Passive									
		OTH Active									
		OTH Passive									
Multi-sensor Sense (MS)	Track	Feature Extraction									
		Identification									
		Common ID									
Situational Assessment (SA)	Tactical Picture Generation	Engagement Status Tracking									
		Battle Damage Assessment									
		Alert Generation									
		Force Planning									
Plan (P)	Operations Planning	Mission Planning									
		Mission Modeling/ Simulation									
		Environmental Prediction									
		Target Prioritization									
Decision (D)	Target/Weapon Pairing	Dynamic Deconfliction									
		Platform Transport									
		Systemic Transport									
		Troop/Cargo Transport									
Force Positioning (FP)	Weapon Initialization and Launch	Fire Control									
		Illumination									
		Intercept									
		Battle Damage Indication									
Engagement Execution (EE)	Electronic Attack	CSD Communications									
		CSD Networking									
		CSD Services									
		CFO Communications									
Infrastructure	CSD	CFO Networking									
		CFO Services									
		CO Communications									
		CO Networking									
	CFO	CO Services									
		CS Communications									
		CS Networking									
		CS Services									
	CO	CS Communications									
		CS Networking									
		CS Services									
		CS Services									
PNT	Gen & Comm Time	Gen & Comm Netw									
		Gen & Comm Netw									
		Gen & Comm Netw									
		Gen & Comm METOC									

System-to-System Mapping (SV-3c)						
	AADC	AWS 7.2 OA	CEC 3.0	CG(X) BL 1.0	E-2C MC	SSDS MK 2
AADC						
AWS 7.2 OA						
CEC 3.0						
CG(X) BL 1.0						
E-2C MC						
SSDS MK 2						
MFR						
RMP						
SPY-1D(V)						
TAMD-S						
TAMD-X						
VSR						

Interface	
●	Direct
◆	Link-16
■	CEC/DDSS

System-to-Platform Mapping (SV-3b)				
Systems	Platform Types			
	CG(X)	CVN	DDG 51	E-2C
AADC	X			
AWS 7.2 OA			X	
CEC 3.0	X	X	X	X
CG(X) BL 1.0	X			
E-2C MC				X
Link-16	X	X	X	X
MFR		X		
RMP (E-2C)				X
AN/SPY-1D(V)			X	
SSDS MK 2		X		
TAMD-S	X			
TAMD-X	X			
VSR		X		

SV-3 Architecture Views Define the Systems, Platforms and Required Connectivity Among Coalition Systems and Provides Details of Connectivity Defining IERs



WEB Enabled Collaborative Engineering

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Collaborative Engineering Environment (CEE)



Coalition System Engineering Facilitated by CEE



Summary and Next Steps

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- ◆ Capstone Requirements Under Discussion
- ◆ C4ISR Architecture Framework 2.0 to Standardize
 - Operational Concept
 - System Functionality and Connectivity
- ◆ Web-Based CEE to Facilitate Development
- ◆ Continued Collaborative between Coalition Partners

Working Towards a Demonstration